
service in ACTION

Agricultural respiratory protective equipment--air-purifying respirators¹

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Quick Facts

Read the label or material safety data sheet (MSDS) as it will specify the type of respiratory protection required.

Store respirators in a sealable, nonporous bag and in an area not exposed to chemicals or other agents that maybe absorbed by the respirator cartridges.

Ensure proper fit.

respirators, goggles, headgear, boots or shoes, aprons, gloves and clothing. To be effective and be capable of protecting you against the specific contaminant, the PPE must be clean, fit properly and be in good working order.

Air-purifying respirators function by filtering contaminants from the air. They **do not** supply oxygen to the wearer. Air-purifying respirators can only protect at or below specific concentrations of contaminants. Labelling on each air-purifying respirator carton or package contains specific information about maximum concentrations and types of contaminants protected by the respirator. If the labelling does not give information about maximum concentration protection levels, contact the manufacturer **or** do not exceed five times the threshold limit value (TLV)³ for that contaminant. Since this is only a rule of thumb, you need to know the actual safe exposure limit for specific hazards.

Introduction

Many harmful air-borne contaminants exist on farms and ranches, i.e., pesticides, dusts, anhydrous ammonia, etc. Worker protection from air-borne contaminants can be accomplished in a variety of ways:

- * **substitute with non-toxic substances:** replace toxic pesticides with biological control agents or mechanical weed control;
- * **engineering controls:** install ventilation systems on tractor cabs and confined spaces;
- * **administrative controls:** rotate workers and restrict reentry into sprayed fields); and
- * **personal protective equipment:** provide respirators, dust masks and clothing.

In some work situations, substituting a less toxic material, engineering and administrative controls are not feasible. In these instances, personal protection is the best line of defense.

Several types of personal protective equipment (PPE) are available for use on the farm or ranch. These include

Types of Respirators

This information provided by:

1. Service in Action 5.020, Cooperative Extension, Colorado State University. Published September 1993. Copyright 1993. For more information, contact your county Cooperative Extension office.

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Checklist of rules to protect you and your employees:

- * Always inspect and test fit with new cartridges. Do not use a respirator that's been sitting around since last season.
- * Clean the respirator daily according to manufacturer's instructions. To extend cartridge life, store the respirator and cartridges in an air-tight bag.
- * Store the respirator in a sealable plastic bag away from contaminants, not in a machine shop or livestock confinement building. The cartridges in the respirator continue to absorb the gases (e.g., exhaust fumes or pit gases) in a storage area until the charcoal has reached its absorption capacity.
- * Follow the test fit instructions.
- * Do not use respirators with beards or other facial hair that pass between the sealing flange of the respirator and the face.
- * Purchase air flow respirators from agricultural chemical and other products dealers, safety supply catalogs and hardware stores.

There are two basic types of air-purifying respirators, disposable and reusable. The disposable respirator comes in two types. The most common disposable respirator is the dust filter mask. Use a dust filter mask whenever suspended dust particles are in the air, which occurs during haying, combining, cultivation of dusty fields, the clean-up of dusty barns and when applying lime and fertilizers. The only recommended dust filter mask has two straps and a tested and certified number (TC#). Placement of the two straps gives a much better fit. Masks with only one strap typically don't provide a seal. Fibrous material used in the dust filter mask physically traps particles. This type of respirator (dust mask) **does not** protect against chemical vapors, gases, toxic pesticide sprays or lack of oxygen. The other type of disposable respirator looks similar to the half-mask (covers the nose and the mouth), cartridge type, reusable respirators; but the cartridge cannot be replaced.

Reusable air-purifying respirators have replaceable filter cartridges. The most common facial types are the half and full face masks. A full face mask covers the nose, mouth and the eyes. If the hazard irritates the skin or eyes, use a full face respirator. Respirator cartridges can be changed with other hazard cartridge types to fit the hazard (i.e., a particulate cartridge to a gases and vapors cartridge). Some cartridges come with pre-filters to use with the respirator cartridge. **Don't forget to use**

them. If you don't use them, you reduce the amount of protection available to you. Cartridges or respirators from one manufacturer cannot be used with cartridges/respirators from another manufacturer. Reusable air-purifying respirators are the type commonly used to protect the user from chemical vapors, dusts and mists. **Cartridge type air-purifying respirators do not protect from lack of oxygen.**

Selection and Use

Air-purifying respirators offer adequate protection against many common agricultural respiratory hazards. Specific limitations that govern the use of these respirators are prior knowledge of the contaminant, the general air quality and the physical surroundings.

There are many considerations during evaluation, selection and use of air-purifying respirators: correct respirator selection, proper fit, necessary regular maintenance, and an assessment of the situation where the respirators will be used. Disregarding any of these items may result in a danger for the wearer due to a false confidence in the respirator's ability to protect. The user of an air-purifying respirator must understand its limitations and recognize situations that require more extensive protection.

Never use air-purifying respirators when:

1. **There is a lack of oxygen.** These respirators only purify air; they **do not** supply oxygen. Determine lack of oxygen, or oxygen deficiency, in one of two ways: **direct measurement equipment** (these devices are available from fire departments and many utility companies) and **evaluation** (tanks, pits, storage bins and tunnels are likely to be oxygen deficient).
2. **Present contaminants do not have warning properties**, e.g., odor, irritant properties or taste. Many contaminants have warning properties at high concentrations. By then it is too late. **Be careful.**

Odor, taste and irritation are easily determined. Many compounds have no warning properties. However manufacturers can inform you of specific warning properties. Detection of contaminants that do not have warning properties can be difficult and therefore, the contaminant can leak through or around a respirator and you won't know it.
3. **The contaminant is extremely toxic (TLV less than 1 ppm).** Consult the product label, material safety data sheet (MSDS) or the manufacturer. Manufacturers of specific chemicals can suggest respirators to be used for specific compounds. Generation of many toxic contaminants can occur in place; e.g., hydrogen sulfide in manure pits and nitrogen dioxide in silos. For additional information, contact your local Colorado State University Cooperative Extension county agent or Cooperative

Extension safety specialist (303-491-6172). For more information on air-borne hazards and pesticide protective equipment, refer to Service in Action 5.019 *Agricultural air-borne hazards* and 5.021 *Agricultural pesticide protective equipment*.

4. **There is an unknown contaminant.** This is the most frequently encountered danger in the work place. Detection of unknown contaminants may require extensive and expensive analytical work. However, it could be a simple and quick procedure.
5. **The contaminant level exceeds the ability of the respirator to protect the wearer.** The label on each respirator carton or package contains specific information about maximum concentrations and types of contaminants protected by the respirator. **Study this label carefully.**
As a rule, if the label does not specify maximum concentrations, do not wear the respirator in atmospheres containing more than five times the allowable concentration of a contaminant. For example: if a safe TLV is 5 (in any unit), never use air-purifying respirators when the concentration goes above 25 units. Knowledge of the air-borne concentration of a contaminant is needed to select proper protection.
6. **The respirator is not approved for the contaminant of concern.** Approval agencies are the National Institute for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA). Approved respirators will have a "TC" (tested and certified) number on the label showing proper approval.
7. **The contaminant has a 'skin' designation.** Unless other PPE is also used, contamination still results through dermal absorption, even with an approved respirator. For example, organo-phosphate pesticides such as Malathion.

With those severe limitations in mind, evaluate each work situation before choosing a respirator. Select a specific respirator designed to function safely within the boundaries you determine. If there is no respirator that fits the limits you select, reevaluate your selection. **Never use an unapproved respirator; your life may depend on it.**

Respirators work by using either a chemical or mechanical filtration system. Chemical cartridges use specially treated activated charcoal or other substances that have a high absorption capacity. Mechanical filter elements provide protection against particulate matter such as dust, mists or metal fumes. Mechanical filters work by physically trapping particulate matter. Unlike chemical filters, mechanical filters become more efficient with use, but make it harder to breathe. Therefore, change them when breathing becomes difficult. Change chemical

filters periodically or when the odor of the contaminant is detected. The time to change filters depends on contaminant concentration and breathing rate of the user.

Testing for Fit

Improper facial fit negates respirator effectiveness. More than one brand and size of a particular type of face piece are available. Therefore, the first task is that the user must understand what a properly fitting face piece is. A properly fitting face piece can be determined with a fitting test. The fitting test uses banana oil, a pungent but non-hazardous oil or irritant smoke, etc. **You must use the correct cartridge for the contaminant.** If you can smell the test substance with the respirator on, then the face piece does not fit properly. Secondly, the user selects the brand that fits properly.

Test different brands of respirators to ensure the best possible fit before purchasing. This is the only way to protect yourself and your employees. When using respirators: make sure the respirator is not deformed; avoid excessive facial hair that may prevent a proper seal; any odor, skin or eye irritation can be an indication of possible leakage.

Features, Advantages and Limitations

The following can be used to compare the features, advantages and limitations of air-purifying respirators.

All chemical cartridges and filters are color coded to reference cartridges to specific applications. Although all manufacturers use color coding, cartridges from one manufacturer are not interchangeable with cartridges from another manufacturer. The following are the color codes:

Acid gases ⁴	White
Organic vapors ⁵	Black
Ammonia gas	Green
Acid gases and organic vapors	Yellow
Highly toxic particulate filter cartridge (HEPA) ⁶	Purple

3. TLV is the time-weighted average concentration for a normal eight-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
4. Acid gases include sulfur dioxide, (SO₂), chlorine gas (Cl₂) and hydrochloric acid (HCl).
5. Pesticides are classified as organic vapors.
6. HEPA= high efficiency particulate attenuation.